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Response to Pahl-Wostl. 2006. "The Importance of Social Learning in Restoring the Multifunctionality of Rivers and Floodplains"

What is Social Learning?

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ABSTRACT. Social learning is increasingly becoming a normative goal in natural resource management and policy. However, there remains little consensus over its meaning or theoretical basis. There are still considerable differences in understanding of the concept in the literature, including a number of articles published in *Ecology & Society*. Social learning is often conflated with other concepts such as participation and proenvironmental behavior, and there is often little distinction made between individual and wider social learning. Many unsubstantiated claims for social learning exist, and there is frequently confusion between the concept itself and its potential outcomes. This lack of conceptual clarity has limited our capacity to assess whether social learning has occurred, and if so, what kind of learning has taken place, to what extent, between whom, when, and how. This response attempts to provide greater clarity on the conceptual basis for social learning. We argue that to be considered social learning, a process must: (1) demonstrate that a change in understanding has taken place in the individuals involved; (2) demonstrate that this change goes beyond the individual and becomes situated within wider social units or communities of practice; and (3) occur through social interactions and processes between actors within a social network. A clearer picture of what we mean by social learning could enhance our ability to critically evaluate outcomes and better understand the processes through which social learning occurs. In this way, it may be possible to better facilitate the desired outcomes of social learning processes.

Key Words: *definition; social-ecological systems; social learning*

This is a response to Davidson-Hunt and Berkes 2003, Pahl-Wostl 2006, Ison and Watson 2007, Mostert et al. 2007, Pahl-Wostl et al. 2007a,b, 2008, Stevaert and Ollivier 2007, Tàbara and Pahl-Wostl 2007, Borowski et al. 2008, Fernandez-Gimenez et al. 2008, Kuper et al. 2009

WHAT'S WRONG WITH OUR CURRENT UNDERSTANDING?

Social learning is increasingly becoming a normative goal in natural resource management (e.g., Parson and Clark 1995, Diduck et al. 2005,

Keen et al. 2005a). This trend is linked to earlier shifts toward adaptive management and stakeholder engagement as a means to cope with complexity and the resultant uncertainty with which managers are faced (Holling 1978, Walters 1986, Walters and Holling 1990). It is argued that those involved in the management of social-ecological systems may learn and therefore enhance their adaptive capacity through their involvement in decision making processes (Folke et al. 2005, Fazey et al. 2007). However, what is social learning? The literature is often vague when it comes to defining the concept and some definitions are so broad they could encompass almost any social process. For example, Ison and Watson (2007) define social learning "as

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achieving concerted action in complex and uncertain situations". In this article, we attempt to clarify the concept of social learning.

Early work conceptualized social learning as individual learning that takes place in a social context and is hence influenced by social norms, e.g., by imitating role models (Bandura 1977). However, this conceptualization is not particularly useful, because most learning takes place in some social context. Recently, a different school of thought has arisen, as reflected in a number of articles in *Ecology and Society* (e.g., Pahl-Wostl 2006, Ison and Watson 2007, Mostert et al. 2007, Pahl-Wostl et al. 2007a,b, Steyaert and Ollivier 2007, Tàbara and Pahl-Wostl 2007, Pahl-Wostl et al. 2008) and elsewhere, including work by the authors of this article (e.g., Reed et al. 2006, Stringer et al. 2006, Prell et al. 2008; Newig et al. 2010).

This literature conceptualizes, often implicitly, social learning as a process of social change in which people learn from each other in ways that can benefit wider social-ecological systems. Originating from concepts of organizational learning (Argyris and Schön 1978, 1996, Senge 1990, Wenger, 1998), this second school of thought is informed by social theories of learning, which define learning as active social participation in the practices of a community (Lave and Wenger 1991, Wenger 1998), and emphasize the dynamic interaction between people and the environment in the construction of meaning and identity (Muro and Jeffrey 2008). However, much of this literature ignores conceptual advancements in the education and psychology literature (Fazey et al. 2007), and there remains little consensus or clarity over the conceptual basis of social learning (Wals and van der Leij 2007).

We identify three key problems with the term as it is currently used in this literature. First, social learning as a concept is frequently confused with the conditions or methods necessary to facilitate social learning, such as stakeholder participation (e.g., Pahl-Wostl 2006, Mostert et al. 2007, Pahl-Wostl et al. 2007a, Steyaert and Ollivier 2007, Borowski et al. 2008, Kuper et al. 2009). Yet, stakeholder participation, which we define as a process whereby individuals, groups, and/or organizations choose to take an active role in decision making processes that affect them (Reed 2008, Newig and Fritsch 2009), and social learning are very different concepts. There is evidence that participatory processes may stimulate and facilitate

social learning (Cundill 2010; A. C. Evely, M. Pinard, I. Fazey, and M. S. Reed, *unpublished manuscript*; A. C. Evely, M. Pinard, X. Lambin, and I. Fazey, *unpublished manuscript*), but it cannot be assumed that participation inevitably implies that social learning takes place (Bull et al. 2008). Indeed, social learning may take place in the absence of any planned participatory process; although social learning occurs from peer-to-peer via social networks, this process may be initiated by mass media or other nonparticipatory means. The conflation of social learning and participation is illustrated in a number of definitions of social learning. For example, Fernandez-Gimenez et al. (2008) define social learning as "an intentional process of collective self-reflection through interaction and dialogue among diverse participants (stakeholders)". Pahl-Wostl et al. (2008) conceptualize social learning as learning how to collaborate: "developing new relational capacities, both between social agents, in the form of learning how to collaborate and understand others' roles and capacities differently." The range and mix of concepts implicitly associated with social learning has greatly reduced the applicability of the concept. Without clarity over the definition of social learning, it becomes very difficult for practitioners to facilitate social learning in social-ecological systems. As a result, there are numerous examples of supposed social learning projects that simply facilitated stakeholder participation; there is rarely any evidence that social learning occurred or any explicit attempt to measure social learning. For example, there is little evidence that the "social learning for the integrated management and sustainable use of water at catchment scale" (SLIM) project facilitated anything more than stakeholder participation (Ison and Watson 2007, Madlener et al. 2007, Stagl 2007) measured single, double, and triple-loop learning at an individual scale, assuming that triple-loop learning equates to social learning.

Second, there is frequently confusion between the concept itself and its potential outcomes (e.g., Pahl-Wostl et al. 2007b). Although social learning may be both a process of people learning from one another and an outcome, i.e., the learning that occurs as a result of these social interactions, it is often defined in relation to the wide range of additional potential outcomes it may have. These include, for example, improved management of social-ecological systems, enhanced trust, adaptive capacity, attitudinal and behavioral change, stakeholder empowerment, strengthening of social

networks, and so on. In particular, social learning is frequently conflated with proenvironmental behavior, which we define as “behavior that has a reduced impact on the environment (including, for example, switching off lights, recycling and using sustainable modes of travel)” (Reid et al., *in press*). For example, Pahl-Wostl et al. (2008) call social learning “sustainable learning” that consists of “developing new identities, as well as institutions and individual capacities, that are more socially and ecologically robust with the common goal of sustainability”. This is echoed by Tàbara and Pahl-Wostl (2007) who assert that “the notion of sustainability as a social learning process is now pervasive...”. Social learning may lead to proenvironmental or sustainable behavior but this is not guaranteed. Mistaking social learning for its potential outcomes is problematic because a range of alternative processes, e.g., monetary incentives, may lead to the same outcomes without social learning taking place at all, and on the other hand, social learning may occur in the absence of any of these outcomes.

Third, despite conceptualizing social learning as a process of social and/or political change, there is often little distinction made between individual and wider social learning (e.g., Davidson-Hunt and Berkes 2003). Learning essentially occurs in an individual through some form of change in a persons’ understanding of the world and their relationship to it (Fazey and Marton 2002). However, the process of learning in individuals most often occurs through social interaction with others and/or facilitative mechanisms such as dissemination of information. More than one person can therefore learn as an emergent property of the reinforcing interactions between people, through networks. The learning that takes place can be at surface levels or involve deeper conceptual change, and can occur at group, community, or societal scales.

As a result, many existing attempts to assess social learning fail to disentangle the effects of an intervention from other mechanisms through which wider learning may have occurred (for example, Pahl-Wostl 2006, Pahl-Wostl et al. 2007a,b, Fernandez-Gimenez et al. 2008, Pahl-Wostl et al. 2008, Kuper et al. 2009). This lack of conceptual clarity has limited our ability to understand the actual function of social learning by linking causes to effects and by assessing whether it has occurred, and if so, what kind of learning has taken place, to

what extent, between whom, when, and how (Armitage et al. 2008). Thus, greater conceptual clarity of social learning is essential to help understand the mechanisms through which it occurs, to develop more effective interventions to promote wider learning, if this is desired, and to design appropriate evaluations to determine if the goals of learning interventions have been met. To this end, the next section extracts three key themes from the social learning literature, which we believe are core to the definition of social learning. We then integrate these three themes to develop our own conceptualization of social learning, which although grounded in previous research, attempts to clear a path through a literature that has become increasingly obscured by confusion between social learning and other concepts, between social learning processes and outcomes, and between individual and social learning.

TOWARD A CLEARER CONCEPTUALIZATION OF SOCIAL LEARNING

A change in understanding

Numerous theoretical frameworks have been developed to understand how we learn. None of these frameworks are specifically about social learning, though they may be able to provide an understanding of the processes upon which social learning is based. For example, Kolb (1984) describes a process where people have concrete experiences, and learn increasingly deeply as they reflect upon these experiences. They are then able to derive abstract concepts from these experiences and apply what they have learned through active experimentation. Alternatively, Mezirow (1995) suggests that learning can be instrumental, i.e., acquiring new knowledge or skills, communicative, i.e., understanding and reinterpreting knowledge through communication with others, or transformative, i.e., where an examination of underlying assumptions leads to change in attitudes, behavior, and social norms. Transformative learning is analogous to “double-loop” learning, i.e., reflecting on the assumptions which underlie our actions, which is distinguished from single-loop learning, i.e., learning about the consequences of specific actions, and triple-loop learning, i.e., learning that challenges the values, norms, and higher order thinking processes that underpin assumptions and actions (Argyris and Schön 1978, Fazey et al. 2005,

Keen et al. 2005a, Keen and Mahanty 2006, Fazey 2010; A. C. Evelyn, M. Pinard, I. Fazey, and M. S. Reed, *unpublished manuscript*).

Learning may occur at any of these levels. It may or may not lead to changes in attitudes, behavior, and norms, and the building of trust, respect, and shared goals (e.g., Ison et al. 2007, Stagl 2007). For social learning to occur, a change in understanding must therefore be demonstrated in the individuals involved. This may only occur at the level of single-loop learning, but if this leads to a change in understanding at a sufficiently broad scale through social interaction, then we would consider this to be social learning. An example of this is the decline in drinking and driving behavior. Although partly a response to the introduction and enforcement of legal penalties, public awareness campaigns in many countries have altered the values and beliefs of those within drunk drivers' social networks, leading to shame and embarrassment in all but the most hardened of repeat offenders (Grasmick et al. 1993, Freeman et al. 2006).

Learning that is situated within wider social units or communities of practice

During the 1990s, there was a shift in the literature from individual learning toward enabling organizations to learn and change (White et al. 2005). Previously, assumptions about learning tended to privilege explicit and abstract knowledge as information acquired by individuals in the form of ideas, facts, and concepts. In contrast, the organizational learning and communities of practice literatures have demonstrated that the fruits of learning can be found in many 'locations', including brains, bodies, routines, dialogue, and symbols (Blackler 1995). This literature argues that it may be possible for social units to learn, whether they be institutions, organizations, or communities of practice, as opposed to large numbers of individuals learning independently (Wals 2007, Armitage et al. 2008). This is similar to Freire's (1970) approach to learning in which people collectively become critically literate about their circumstances, achieving 'conscientização' through collective reflection and problematization. Although group processes can suppress the knowledge of individual group members through the development of a shared and closed perspective of the world (Janis's [1989] "groupthink"), there is evidence that collective learning can perform better than the sum

of individual learning, as demonstrated in studies of organizational learning (Senge 1990, Argyris and Schön 1996), and the "wisdom of crowds" (Surowiecki 2004).

The potential to influence numerous individuals to make decisions that benefit wider society has focused the attention of a number of fields onto social learning. For example, there has been increasing use of the social learning concept in adult learning to teach citizenship. Here, the belief is that good citizenship can be learned, not from a formal curriculum but instead through positive experiences of active involvement within society (Wildemeersch et al. 1998, Benn 2000). This approach stresses the importance of creating adequate conditions to link experiences, reflection, and experimentation between individuals and groups (Kolb 1984, Nonaka and Takeuchi 1995). Reflecting this, in the field of natural resource management, Keen et al. (2005b:4) have defined social learning as "the collective action and reflection that takes place amongst both individuals and groups when they work to improve the management of the interrelationships between social and ecological systems." That is, for a phenomenon to be described as social learning, it must demonstrate a change or understanding that goes beyond individuals or small groups to become situated within wider social units or communities of practice. In this context, groups of individuals brought together by researchers rarely correspond to naturally occurring communities of practice; instead they typically include representatives from a number of different communities of practice. As such, for social learning to occur, the ideas and attitudes learned by members of the small group must diffuse to members of the wider social units or communities of practice to which they belong.

Learning through social interaction

This leads us to the third key theme emerging from the social learning literature, that it is not just the change in understanding or the scale at which it takes place that denotes social learning, it is also the mode through which learning occurs. As such, a successful mass media campaign that achieved a societal change in understanding about an issue could not be considered social learning unless the message also spread from person to person through social networks. Social networks were traditionally conceptualized as the link between the micro, e.g., individual and local, and the macro level, e.g.,

institutions, culture, and collective norms, elements of a system (Granovetter 1973, Coleman 1990, Ritzer and Goodman 2004). More recent literature on social networks indicates how networks influence people's opinions and views (Hunter et al. 1991, Friedkin 1998, Stevenson and Greenberg 2000, Katz and Lazarsfeld 2006, Winter et al. 2007). Such influence can occur on a one-to-one basis through social interaction (Erickson 1988), but more importantly, influence through networks results from the larger network structure in which actors are embedded (Coleman 1990; Prell et al. 2010). Learning may occur through two basic types of social interaction: information transmission, i.e., simple learning of new facts through social interaction, and deliberation (Newig et al. 2010) on ideas by Habermas (1981), which refers to a genuine exchange of ideas and arguments during which ideas and perceptions change through persuasion. Rist et al. (2007) build on this, arguing that social learning requires the creation or enhancement of social space for what Habermas (1981) calls "communicative action," e.g., through new social movements. In this way, social learning may lead to changes in social networks and wider societal, and institutional structures. In this context, Rist et al. (2007:23) conceptualize social learning as a process where "different actors can deliberate and negotiate rules, norms and power relations," which they facilitate through workshops with natural resource users.

Social interactions that take place during such environmental decision making processes influence the kinds of learning that take place (Bandura 1977, Pea, 1993, Pahl-Wostl and Hare 2004, Prell et al. 2008). Such learning through interaction is, for example, constrained by the established norms found within the social contexts in which individuals are embedded (Wenger 1998; Prell et al. 2010). Such contexts include not only institutions, but also the networks and network structures in which individuals and groups are embedded (Coleman 1990; Newig et al. 2010; Prell et al. 2010), and the epistemological beliefs and world views of people in that social context (Evely et al. 2008, Miller et al. 2008). Although it is not a requirement of social learning, it is more likely to occur if groups with different types of knowledge, e.g., local vs scientific, share similar epistemological beliefs (Webler et al. 1995, Greenwood and Levin 1998, Evely et al. 2008, Raymond et al. 2010).

Finally, it should be noted that the roles of power and scale in influencing learning outcomes are particularly important when assessing the extent to which learning has taken place as a result of social interaction. Creating contexts in which social learning might take place entails a commitment to bring together people who have very different world views and knowledge systems (A. C. Evely, M. Pinard, I. Fazey, and M. S. Reed, *unpublished manuscript*). The power dynamics implicit in bringing different knowledge holders together influence the subsequent learning outcomes (Wildemeersch 2007). Indeed, scholars have warned that cross-scale networks characterized by strong linkages and nesting hold the potential to create opportunities for actors operating at broader scales to mobilize knowledge and exert power over local resource users (Adger et al. 2006). Therefore, assuming that high levels of interaction between stakeholders in any given situation will lead to social learning is simplistic (Cundill 2010), and a deeper understanding of the context, power dynamics, and values that influence the ability of people and organizations to manage natural resources effectively is necessary (Keen et al. 2005b).

CONCLUSIONS

In summary, researchers have defined social learning in multiple, overlapping ways and confused social learning with the conditions and methods necessary to facilitate social learning or its potential outcomes. We emphasize the need to distinguish social learning as a concept from the conditions or methods that may facilitate social learning, e.g., stakeholder participation, and the potential outcomes of social learning processes, e.g., proenvironmental behavior. Building on this discussion, we propose that if learning is to be considered "social learning," then it must:

1. Demonstrate that a change in understanding has taken place in the individuals involved. This may be at a surface level, e.g., via recall of new information, or deeper levels, e.g., demonstrated by change in attitudes, world views or epistemological beliefs;
2. Go beyond the individual to become situated within wider social units or communities of practice within society; and Occur through

social interactions and processes between actors within a social network, either through direct interaction, e.g., conversation, or through other media, e.g., mass media, telephone, or Web 2.0 applications.

As such, social learning may be defined as a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks.

We hope that this response helps to clarify the conceptual basis for social learning, and initiates a discussion about what we really mean by the term. If future research builds on the understanding that emerges from this discussion, we will be able to more effectively facilitate social learning processes that may potentially enhance the sustainability of social-ecological systems. Future research also needs to assess the extent to which social learning occurs in different social-ecological systems, to what extent it is facilitated by participatory processes, how such processes can be designed to better facilitate social learning, and to what extent this then leads to positive social-ecological outcomes. Two ongoing projects^[1] are currently addressing these questions, using a combination of meta-analysis and in-depth case study work, but more research is needed.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/volXX/issYY/artZZ/responses/>

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LITERATURE CITED

Adger, W. N., K. Brown, and E. Tompkins. 2006. The political economy of cross-scale networks in resource co-management. *Ecology and Society* **10** (2): 9. [online] URL: www.ecologyandsociety.org/vol10/iss2/art9.

Argyris, C., and D. A. Schön. 1978. *Organizational learning: a theory of action perspective*. Jossey-Bass, San Francisco, California, USA.

Argyris, C., and D. A. Schön. 1996. *Organizational learning II: theory, method and practice*. Addison Wesley, Reading, Massachusetts, USA.

Armitage, D., M. Marschke, and R. Plummer. 2008. Adaptive co-management and the paradox of learning. *Global Environmental Change* **18**:86-98.

Bandura, A. 1977. *Social learning theory*. Prentice Hall, Englewood Cliffs, New Jersey, USA.

Benn, R. 2000. The genesis of active citizenship in the learning society. *Studies in the education of adults*. **32**:241-256.

Blackler, F. 1995. Knowledge, knowledge work, and organizations: an overview and interpretation. *Organization Studies* **16**:1021-1046.

Borowski, I., J. Le Bourhis, C. Pahl-Wostl, and B. Barraqué. 2008. Spatial misfit in participatory river basin management: effects on social learning. a comparative analysis of German and French case studies. *Ecology and Society* **13**(1): 7. [online] URL: <http://www.ecologyandsociety.org/vol13/iss1/art7/>.

Bull, R., J. Petts, and J. Evans. 2008. Social learning from public engagement: dreaming the impossible? *Journal of Environmental Planning and Management* **51**(5): 701-716.

Coleman, J. S. 1990. *Foundations of social theory*. Harvard University of Press, Cambridge, Massachusetts, USA.

Cundill, G. 2010. Monitoring social learning processes in adaptive comanagement: three case studies from South Africa. *Ecology and Society* **15** (3): 28. [online] URL: <http://www.ecologyandsociety.org/vol15/iss3/art28/>.

Davidson-Hunt, I., and F. Berkes. 2003. Learning as you journey: Anishinaabe perception of social-ecological environments and adaptive learning. *Conservation Ecology* **8**(1): 5. [online] URL: <http://www.consecol.org/vol8/iss1/art5/>.

Diduck, A., N. Bankes, D. Clark, and D. Armitage. 2005. Unpacking social learning in social-ecological systems: case studies of polar bear and narwhal management in northern Canada. In F. Berkes, R. Huebert, H. Fast, M. Manseau, and A. Diduck, editors. *Breaking ice: renewable resource and ocean management in the Canadian North*. Northern Light Series, Arctic Institute of North America and University of Calgary Press, Calgary, Alberta, Canada.

Erickson, B. 1988. The relational basis of attitudes. In B. Wellman, and S. D. Berkowitz, editors. *Social structures: a network approach*. Cambridge University Press, Cambridge, UK.

Evely, A. C., I. Fazey, M. Pinard, and X. Lambin. 2008. The influence of philosophical perspectives in integrative research: a conservation case study in the Cairngorms National Park. *Ecology and Society* **13**(2): 52. [online] URL: <http://www.ecologyandsociety.org/vol13/iss2/art52/>.

Fazey, I. 2010. Resilience and higher order thinking. *Ecology and Society* **15**(3): 9. [online] URL: <http://www.ecologyandsociety.org/vol15/iss3/art9/>.

Fazey, I., J. A. Fazey, and D. M. A. Fazey. 2005. Learning more effectively from experience. *Ecology and Society* **10**(2): 4. [online] URL: <http://www.ecologyandsociety.org/vol10/iss2/art4/>.

Fazey, I., J. A. Fazey, J. Fischer, K. Sherren, J. Warren, R. Noss, and S. Dovers. 2007. Adaptive capacity and learning to learn as leverage for social-ecological resilience. *Frontiers in Ecology and Environment* **5**:375-380.

Fazey, J. A., and F. Marton. 2002. Understanding the space of experiential variation. *Active Learning in Higher Education* **3**:234-250.

Fernandez-Gimenez, M. E., H. L. Ballard, and V. E. Sturtevant. 2008. Adaptive management and social learning in collaborative and community-based monitoring: a study of five community-based forestry organizations in the western USA. *Ecology and Society* **13**(2): 4. [online] URL: <http://www.ecologyandsociety.org/vol13/iss2/art4/>.

Folke, C., T. Hahn, P. Olsson, and J. Norberg. 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* **30**: 441-73.

Freeman, J., P. Liossis, C. Schonfeld, M. Sheehan, V. Siskind, and B. Watson. 2006. The self-reported impact of legal and non-legal sanctions on a group of recidivist drunk drivers. *Transportation Research* **9**:53-64.

Freire, P. 1970. *Pedagogy of the Oppressed*. Harmondsworth, Penguin, London, UK.

Friedkin, N. E. 1998. *A structural theory of social influence*. Cambridge University Press, Cambridge, UK.

Granovetter, M. 1973. The strength of weak ties. *American Journal of Sociology* **78**:1360-1380.

Grasmick, H. G., R. J. Bursik, and B. J. Arneklev. 1993. Reduction in drunk driving as a response to increased threats of shame, embarrassment, and legal sanctions. *Criminology* **31**:41-67.

Greenwood, D. J., and M. Levin. 1998. *Introduction to action research: social research for social change*. Sage Publications, Thousand Oaks, California, USA.

Habermas, J. 1981. *The theory of communicative action: reason and the rationalization of society. Volume 1*. Beacon Press, Boston, Massachusetts, USA.

Holling, C. S. 1978. *Adaptive environmental assessment and management*. John Wiley and Sons, London, UK.

Hunter, S. M., I. A. Vizelberg, and G. S. Berenson. 1991. Identifying mechanisms of adoption of tobacco and alcohol use among youth: the Bogalusa heart study. *Social Networks* **13**:91-104.

Ison, R., N. Roling, and D. Watson. 2007. Challenges to science and society in the sustainable management and use of water: investigating the role of social learning. *Environmental Science & Policy* **10**:499-511.

Ison, R., and D. Watson. 2007. Illuminating the possibilities for social learning in the management of Scotland's water. *Ecology and Society* **12**(1): 21. [online] URL: <http://www.ecologyandsociety.org/vol12/iss1/art21/>.

Janis, I. 1989. Groupthink: the problems of conformity. Pages 224-228 in G. Morgan, editor. *Creative organization theory*. Sage, London, UK.

Katz, E., and P. F. Lazarsfeld. 2006. *Personal influence: the part played by people in the flow of mass communications*. Transaction Publishers, New Brunswick, New Jersey, USA.

Keen, M., V. A. Brown, and R. Dyball. 2005a. *Social learning in environmental management: towards a sustainable future*. Earthscan, London, UK.

Keen, M., T. Bruck, and R. Dyball. 2005b. Social learning: a new approach to environmental management. Pages 3-21 in M. Keen, V. Brown, and R. Dyball, editors. *Social learning in environmental management: towards a sustainable future*. Earthscan, London, UK.

Keen, M., and S. Mahanty. 2006. Learning in sustainable natural resource management: challenges and opportunities in the Pacific. *Society and Natural Resources* **19**:497-513.

Kolb, D. A. 1984. *Experiential learning: experience as the source of learning and development*. Prentice-Hall, Upper Saddle River, New Jersey, USA.

Kuper, M., M. Dionnet, A. Hammani, Y. Bekkar, P. Garin, and B. Bluemling. 2009. Supporting the

shift from state water to community water: lessons from a social learning approach to designing joint irrigation projects in Morocco. *Ecology and Society* **14**(1): 19. [online] URL: <http://www.ecologyandsociety.org/vol14/iss1/art19/>.

Lave, J., and E. Wenger. 1991. *Situated learning: legitimate peripheral participation*. Cambridge University Press, Cambridge, UK.

Madlener, R., K. Kowalski, S. Stagl. 2007. New ways for the integrated appraisal of national energy scenarios: the case of renewable energy use in Austria. *Energy Policy* **35**:6060-6074.

Mezirow, J. 1995. Transformation theory of adult learning. In M. Welton, editor. *In defense of the lifeworld: critical perspectives on adult learning*. State University of New York Press, Albany, New York, USA.

Miller, T. R., T. D. Baird, C. M. Littlefield, G. Kofinas, F. S. Chapin III, and C. L. Redman. 2008. Epistemological pluralism: reorganizing interdisciplinary research. *Ecology and Society* **13**(2): 46. [online] URL: <http://www.ecologyandsociety.org/vol13/iss2/art46/>.

Mostert, E., C. Pahl-Wostl, Y. Rees, B. Searle, D. Tàbara, and J. Tippett. 2007. Social learning in European river-basin management: barriers and fostering mechanisms from 10 river basins. *Ecology and Society* **12**(1): 19. [online] URL: <http://www.ecologyandsociety.org/vol12/iss1/art19/>.

Muro, M., and P. Jeffrey. 2008. A critical review of the theory and application of social learning in participatory natural resource management. *Journal of Environmental Planning and Management* **51**:325-344.

Newig, J., and O. Fritsch. 2009. Environmental governance: participatory, multi-level and effective? *Environmental Policy and Governance* **19**:197-214.

Newig, J., D. Günther, and C. Pahl-Wostl. 2010. In the network. Learning in governance networks in the context of environmental management. *Ecology and Society*, in press.

Nonaka, I., and H. Takeuchi. 1995. *The knowledge-creating company*. Oxford University Press, Oxford, UK.

Pahl-Wostl, C. 2006. The importance of social learning in restoring the multifunctionality of rivers and floodplains. *Ecology and Society* **11**(1): 10. [online] URL: <http://www.ecologyandsociety.org/vol11/iss1/art10/>.

Pahl-Wostl, C., M. Craps, A. Dewulf, E. Mostert, D. Tàbara, and T. Taillieu. 2007a. Social learning and water resources management. *Ecology and Society* **12**(2): 5. [online] URL: <http://www.ecologyandsociety.org/vol12/iss2/art5/>.

Pahl-Wostl, C., and M. Hare. 2004. Processes of social learning in integrated resources management. *Journal of Community and Applied Social Psychology* **14**:193-206.

Pahl-Wostl, C., E. Mostert, and D. Tàbara. 2008. The growing importance of social learning in water resources management and sustainability science. *Ecology and Society* **13**(1): 24. [online] URL: <http://www.ecologyandsociety.org/vol13/iss1/art24/>.

Pahl-Wostl, C., J. Sendzimir, P. Jeffrey, J. Aerts, G. Berkamp, and K. Cross. 2007b. Managing change toward adaptive water management through social learning. *Ecology and Society* **12**(2): 30. [online] URL: <http://www.ecologyandsociety.org/vol12/iss2/art30/>.

Parson, E. A., and W. C. Clark. 1995. Sustainable development as social learning: theoretical perspectives and practical challenges for the design of a research program. Pages 428-60 in L. H. Gunderson, C. S. Holling, and S. S. Light, editors. *Barriers and bridges to the renewal of ecosystems and institutions*. Columbia University Press, New York, New York, USA.

Pea, R. 1993. Practices of distributed intelligence and designs for education. Pages 47-87 in G. Salomon, editor. *Distributed cognition: psychological and educational considerations*. Cambridge University Press, Cambridge, UK.

Prell, C., K. Hubacek, C. H. Quinn, and M. S. Reed. 2008. 'Who's in the network?' When stakeholders influence data analysis. *Systemic Practice and Action Research* **21**:443-458.

Prell, C., K. Hubacek, M. S. Reed, R. Liat. 2010. Competing structures, competing views: the role of

formal and informal social structures in shaping stakeholder perceptions. *Ecology and Society*, in press.

Raymond, C. M., I. Fazey, M. S. Reed, L. C. Stringer, G. M. Robinson, and A. C. Evelyn. 2010. Integrating local and scientific knowledge for environmental management: from products to processes. *Journal of Environmental Management* **91**:1766-1777

Reed, M. S. 2008. Stakeholder participation for environmental management: a literature review. *Biological Conservation* **141**:2417-2431

Reed, M. S., E. D. G. Fraser, A. J. Dougill. 2006. An adaptive learning process for developing and applying sustainability indicators with local communities. *Ecological Economics* **59**:406-418.

Reid, L., P. Sutton, and C. Hunter. In Press. Theorising the meso level: the household as a crucible of pro-environmental behaviour. *Progress in Human Geography*.

Rist, S., M. Chidambaramanathan, C. Escobar, U. Wiesmann, and A. Zimmermann. 2007. Moving from sustainable management to sustainable governance of natural resources: the role of social learning process in rural India, Bolivia and Mali. *Journal of Rural Studies* **23**:23-37.

Ritzer, G., and D. J. Goodman. 2004. *Sociological theory*. McGraw-Hill, Boston, USA.

Senge, P. M. 1990. The leader's New Work: building learning organizations. *Sloan Management Review* 7-23.

Stagl, S. 2007. Theoretical foundations of learning processes for sustainable development. *International Journal of Sustainable Development and World Ecology* **14**:52-62.

Stevenson, W. B., and D. Greenberg. 2000. Agency and social networks: strategies of action in a social structure of position, opposition, and opportunity. *Administrative Science Quarterly* **45**:651-678.

Steyaert, P., and G. Ollivier. 2007. The European water framework directive: how ecological

assumptions frame technical and social change. *Ecology and Society* **12**(1): 25. [online] URL: <http://www.ecologyandsociety.org/vol12/iss1/art25/>.

Stringer, L. C., A. J. Dougill, E. Fraser, K. Hubacek, C. Prell, and M. S. Reed. 2006. Unpacking "participation" in the adaptive management of social-ecological systems: a critical review. *Ecology and Society* **11**(2): 39. [online] URL: <http://www.ecologyandsociety.org/vol11/iss2/art39/>.

Surowieck, J. 2004. *The wisdom of crowds*. Random House, New York, New York, USA.

Tàbara, J. D., and C. Pahl-Wostl. 2007. Sustainability learning in natural resource use and management. *Ecology and Society* **12**(2): 3. [online] URL: <http://www.ecologyandsociety.org/vol12/iss2/art3/>.

Walters, C. 1986. *Adaptive management of renewable resources*. Macmillan, New York, New York, USA.

Walters, C., and C.S. Holling. 1990. Large scale management experiments and learning by doing. *Ecology* **71**:2060-2068.

Wals, A. E. J. 2007. Learning in a changing world and changing in a learning world: reflexively fumbling towards sustainability. *Southern African Journal of Environmental Education* **24**:35-45.

Wals, A., and T. van der Leij. 2007. Introduction. Pages 17-32 in A. Wals, editor. *Social learning: towards a sustainable world*. Wageningen Academic Publishers, Wageningen, The Netherlands.

Webler, T., H. Kastenholz, and O. Renn. 1995. Public participation in impact assessment: a social learning perspective. *Environmental Impact Assessment Review* **15**:443-463.

Wenger, E. 1998. *Communities of practice: learning, meaning, and identity*. Cambridge University Press, New York, New York, USA.

White, R., A. Fischer, H. P. Hansen, R. Varjopuro, J. Young, and M. Adamescu. 2005. *Conflict management, participation, social learning and attitudes in biodiversity conservation*. ALTERNet document WPR4-2005-03, Project no. GOCE-CT-2003-505298.

Wildemeersch, D. 2007. Social learning revisited: lessons learned from north and south. Pages 99-116 in A. Wals, editor. *Social learning: towards a sustainable world*. Wageningen Academic Publishers, Wageningen, The Netherlands.

Wildemeersch, D., T. Jansen, J. Vandenabeele, and M. Jans. 1998. Social Learning. A new perspective on learning in participatory systems. *Studies in Continuing Education* **20**:251-265.

Winter, S., H. Prozesky, and K. Esler. 2007 A case study of landholder attitudes and behaviour toward the conservation of renosterveld, a critically endangered vegetation type in Cape Floral Kingdom, South Africa. *Environmental Management* **40**:46-61.

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